careful inquiry, Budd knew that fever had not been present in the village for at least 15 years—"There was nothing," he said, "to separate from the open air the offensive matters which collect around human habitations. Each cottage, or group of three or four cottages, had its common privy, to which simple excavation in the ground served as a cesspool." Also, nearly every farm labourer kept his pig to "furnish manure for the little plot of potatoes which fed man and pig alike. Thus, often, hard by the cottage door there was not only an open privy, but a dungheap also." Thus the atmospheric conditions considered necessary for the propagation of fever were present, and always had been. "Meanwhile privies, pigstyes and dungheaps continued, year after year, to exhale ill odours, without any specific effect on the public health."

In July the first case occurred; by November there had been more than 80 cases. It was by watching the spread of the disease within the families and neighbouring villages that Budd was able to demonstrate its contagious nature. When the disease was at its height three people left the village after they had been infected, and communicated it to others in their new neighbourhoods. Two were sawyers who had hired themselves out to a timber merchant in North Tawton for a few weeks, and had lodged in a court with a common privy. Both, when they sickened, returned to their homes in Morchard. One, a married man, died after passing the disease to his two children; his widow escaped. The other, a single man, infected a friend who visited him, and gave the disease to his brother and two of his children. The third person to leave North Tawton was a widow who went to visit her brother at Chaffcombe about seven miles away and started a series of cases: her sister-in-law, her brother, several farm labourers and apprentices, and other servants were affected. A servant-girl, in order to lessen the burden of sick nursing, went to her home in Loosebeare about four miles away and there started a small epidemic in the village. Budd points out that "while at Loosebeare a large proportion of the inhabitants were lying prostrate with fever, in not one of the 20 or 30 exactly similar places was there a single case." From Chaffcombe, again, one of the boys went home to his mother's cottage, half-way between Bow and North Tawton, and caused the illness of his mother and the death of his sister, and from there a further series of cases resulted.

Step by step Budd showed how the disease had been passed from one person to another. Soon after, he moved to Bristol, where he became an honorary and consulting physician to the Bristol Royal Infirmary. Whenever opportunity occurred, he collected further cases to illustrate his hypothesis. These he published in 1873 in a book, *Typhoid Fever; its nature, mode of spreading and prevention.*

Conclusion

What are the lessons to be learnt from these disjointed jottings? First, I would say, that history shows us that epidemic disease is always threatening, and when one appears to have been conquered or has spent its force others take its place, sometimes appearing insidiously, so that at first we hardly realize the changing pattern of disease in our midst—sometimes, with catastrophic force, breaking into our daily lives, as Asiatic cholera did in 1832 and influenza did in 1918. Even to-day we find fresh diseases coming amongst us unexpectedly. The polio epidemics which we have experienced since the war are an example. Epidemics of Bornholm disease which have caused considerable trouble in various parts of the country during the past year are another. What, I wonder, will our future historians say about the epidemics of this age?

When it comes to the study of epidemiology, those situated in country districts, serving isolated communities, are in a far better position to help in unravelling the spread of disease. With an active chain of public health laboratories at the disposal of the country doctor, he can now make very real contributions to the advancement of medical science.

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CHILDREN'S VISION AND TELEVISION

BY

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General Effects of Television on Child Development

The possible adverse or beneficial effects of television viewing on the physical, social, and mental development of children rarely form the subject of articles or discussions in medical journals, and only a few surveys have been carried out in order to determine these effects. This is surprising, as there are television sets in half the homes of the country, and during the last 10 years television viewing has developed from a curious pastime of a few Londoners into a regular nightly drawn-out vigil practised by a large mass of the population.

The existence of television in a home must necessarily affect the pattern of life of that family, probably only to a negligible degree but possibly to a considerable extent. It has been stated that the less-educated members of the community, those who have nothing in particular to do, and those in the lower socio-economic group take to television more readily and change their habits more radically than other sections of the community do.

The acquisition of a television set may accentuate the financial difficulties of some families, thereby adversely affecting the quality of meals and the standards of comfort provided; and outside the home it may restrict social, recreational, and other mentally or physically beneficial activities. On the other hand, the lure of the screen may induce parents to remain at home rather than visit public houses, clubs, etc., and encourage children to stay in instead of going to cinemas or wandering aimlessly in the streets. Does this mean that television encourages a more compact family life, or does it encourage each member to stare mutely at the screen instead of contributing to the intimate family chatter? Where members of the family have no hobbies, do not read, and have no interesting conversation to offer, it relieves the boredom of home life.

A survey carried out in Coventry revealed that one-fifth of the teenage children questioned admitted that television interfered appreciably with their homework. The programmes may stimulate thought, improve appreciation of the arts, extend knowledge of literature, and produce better understanding of social problems, but they may also encourage a child to depend on ready-made entertainment, dampen initiative, discourage rational reasoning, and decrease his readiness to accept responsibilities. The youth club which the child may

otherwise be attending might have fostered his social and emotional development better than the television.

The effects of television on the emotional development of children have not been assessed generally. In Minneapolis it was found that the younger children enjoyed western and adventure programmes which were really beyond their mental capacity to understand properly, whereas the older children, who are more subject to corruption and delinquency, preferred plays and sports programmes. It may be that the emotionally balanced and stable children are not disturbed by television programmes, but the emotionally weak find that artificially produced stresses create added emotional strains with which they cannot cope.

Television may affect the physical development of children. Dr. J. L. Dunlop, Principal School Medical Officer for Hertfordshire, reported that children tended to stay up late to watch the television, that they looked permanently tired and drowsy, and that those with defective vision suffered from eye strain. On the other hand, Dr. J. A. Scott, Principal School Medical Officer of the London County Council, is less emphatic on this point and suggests that the amount of sleep children obtain has not changed, because if a parent allows a child to be late to bed for one reason, be it television or cinema, the same parent would probably permit late hours in the absence of these particular attractions. This is in agreement with the findings of a B.B.C. survey in 1952, which found that young children watched the television on average under nine hours weekly and the older children over 11 hours weekly. Muscle fatigue and postural deformities may result if children maintain bad postures for long periods.

Reasons for Cardiff Survey

The eye muscles undergo the greatest physical strain, for they are continuously endeavouring to adjust the optical system in order that a clear, easily interpreted image may be received on the retina. The visual object may be blurred, moving, flickering, or badly illuminated. This strain on the eye muscles may be even more marked if an uncorrected error of refraction exists in the eyes of the viewer. Eye strain, if and when it occurs, may impair the efficiency of children's eyes as an optical system. It was this possibility of impaired vision resulting from television viewing that led to a survey being carried out in Cardiff. It was considered that if television viewing as practised by schoolchildren to-day causes eyestrain sufficient to affect children's eyesight we would find a greater proportion of children wearing glasses among the frequent television viewers than among the non-viewers. In this survey all children who have a television set at home, be it recently acquired or not, are placed in the same group as frequent television viewers, while those without a set at home are the comparatively infrequent viewers.

Incidence of Television Sets in Cardiff Schoolchildren's Homes

The investigation was done by school nurses in Cardiff during the autumn term of 1956. A total of 19,280 Cardiff junior and secondary modern school children aged 7–14 years were asked whether or not they had television sets in their own homes and whether or not they wore glasses or had been advised by ophthalmologists or opticians to wear glasses. Of the children questioned, 64.9% claimed to have television in their own homes, the percentage being rather higher for the younger children than for the older ones (Table I). This probably indicates that younger parents are more likely than the older ones to invest in television.

TABLE I.—*Prevalence of Television in Homes of Cardiff Children, Autumn, 1956*

Age	No. of Children Questioned	Having Television in Own Homes	
		No.	%
7 years ..	3,061	2,035	66
8 ,, ..	3,557	2,327	65
9 ,, ..	3,814	2,595	68
10 ,, ..	2,957	1,972	67
11 ,, ..	1,604	1,003	63
12 ,, ..	1,430	880	62
13 ,, ..	1,444	858	59
14 ,, ..	1,413	847	60
Total ..	19,280	12,517	64·9

Nearly all the television sets had been acquired since August, 1952, when the Wenvoe transmitting station was opened and reception became possible in the Cardiff area. Two-thirds of the children living in council houses had television sets, so the prevalence of television is approximately the same in council estates as in other areas. As the average council house tenant earns about £10 10s. a week and pays £1 10s. rent, the question of whether the additional cost of 15s. a week over a period of two years for a television set constitutes a serious financial burden is one that cannot be answered readily in general terms.

The method adopted in this investigation of determining whether children's vision is being adversely affected by television viewing is open to criticism. For example, parents who have television sets may be more thrifty, more careful in the management of their affairs, and more ready to seek advice regarding their children's handicaps. It may be that television viewing may have made some parents realize that their children's vision was unsatisfactory, whereas otherwise the defect would have passed unnoticed. Lastly, it may have caused parents to seek ophthalmic advice, with the result that minimal optical defects have been treated by optical correction, whereas otherwise they would not have been detected. On the whole, therefore, we would expect a greater proportion of the television viewers than of the non-viewers to be wearing glasses.

Incidence of Spectacles Among Child Viewers and Non-viewers

The incidence of schoolchildren wearing glasses is slightly higher among those with television sets, but the difference is not statistically significant, and, in view of the previous remarks, is not more than would be expected. When, however, the percentages of children with glasses at various ages are examined we find that the incidence of glasses is a little lower in the viewers group under 10, but much higher after that age.

TABLE II.—*Numbers and Percentages of Children Prescribed Glasses Among Those With and Those Without Television Sets at Home*

Age	No. of Children Questioned	Prescribed Glasses	
		No.	%
Those with Television			
7 years ..	2,035	159	7·8
8 ,, ..	2,327	192	8·3
9 ,, ..	2,595	278	10·7
10 ,, ..	1,972	243	12·3
11 ,, ..	1,003	170	16·9
12 ,, ..	880	151	17·2
13 ,, ..	858	139	16·2
14 ,, ..	847	150	17·7
Total .	12,517	1,482	11·8
Those Without Television			
7 years ..	1,026	80	7·8
8 ,, ..	1,230	109	8·9
9 ,, ..	1,219	141	11·6
10 ,, ..	985	109	11·1
11 ,, ..	601	86	14·3
12 ,, ..	550	73	13·3
13 ,, ..	586	91	15·5
14 ,, ..	566	83	14·7
Total ..	6,763	772	11·4

Of the 5,560 children aged 10 or over who have television 15.3% had been prescribed glasses, but of the 3,288 children of the same ages who did not have television sets only 13.4% have been prescribed glasses. The standard error of the difference between these two proportions is 0.76, which, when doubled, is still below the actual difference in proportions—namely, 1.9. The difference between the incidence of glasses in the two groups is therefore not likely to be due to chance, and is statistically significant. The difference between the incidence of children wearing glasses is even greater (17% − 14% = 3%) in children aged 11 and over; and this again is statistically significant, as the standard error of difference between the two proportions is 0.96.

The higher incidence of children prescribed glasses in the television-viewing group aged 11 and over is not therefore a matter of chance. It cannot be taken for granted that television viewing in itself is the main or even a contributory factor. As stated earlier, there are many factors that could possibly increase the incidence of glasses among child viewers, but the survey shows that the significant factor or factors affect only the children over the age of 10.

There are at least three possible reasons why a significant difference in the proportion of children prescribed glasses was found only in those over the age of 10. First, Cardiff schoolchildren have routine vision tests at the ages of 5, 10, and 14 years, so most of those aged 7–9 have not had a vision test during the last two years at least. Therefore if television viewing has impaired the vision of some of these children it will not show in the figures obtained in this survey, as many of them have watched the television only during the last two years and have had no vision tests during that time. The same applies to the 13-year-old children, for they too have had no routine vision tests for over two years, and this fact is presumably the reason why the difference between the two percentages is less for the 13-year-olds than for any other age group after 10.

The second reason is that children over the age of 10, having reached the secondary modern schools, are allowed to stay up longer in the evenings to watch television.

The third reason is that children up to the age of 8 can usually cope with eye-straining conditions without the optical efficiency of their eyes being impaired, but in children over that age eye strain may accelerate and exaggerate the normal tendency towards myopia. The axial length of the newborn eye is 16 mm., but that of a child of 7 is 24 mm. Therefore, as the axial length of the eye increases considerably during the first few years of life, the optical system tends to become myopic, but this is prevented by a gradual decrease in the convexity of the lens and changes in the refractive indices of the cortex and nucleus. In fact, during the first seven years of life there is a slight increase in hypermetropia among half to three-quarters of children, but between the ages of 8 and 13 there is a rapid decrease in hypermetropia or an increase in myopia. Accentuation of this process during the ages of 8 and 13 accounts for the increase in the number of children with vision defects normally discovered at these ages.

TABLE III.—*Number of Cardiff Schoolchildren Found with Defective Vision at Routine School Medical Inspection in* 1955

Age when Examined	No. Examined	New Cases Requiring Treatment for Defective Vision	
		No.	%
5–	4,342	99	2·3
10–	4,287	246	5·7
14+	2,158	185	8·6

Eye Strain

Eye strain caused by constant difficulties of accommodation can and often does artificially exaggerate this trend towards myopia in those aged 8–13 years. Eye strain is defined as symptoms experienced in the conscious striving of the visual apparatus to clarify vision by ineffectual adjustments. It depends on the uses to which the eyes are put, the efficiency of the visual apparatus, and the capacity of the individual to withstand sustained effort. The causes are numerous, but, whereas the novice may experience eye strain, frequent use and training may enable him eventually to manage the same task with a certain degree of smoothness and ease. For instance, the quick reader does not have to use his eyes so exactingly as the slow reader, who has to study each word.

The causes of eye strain are listed as :

1. Visual factors (mainly those which cause muscle fatigue). (*a*) Accommodation asthenopia. (*b*) Strain on neuromuscular control of ocular movements in order to maintain convergence.

2. Light: (*a*) Illumination: (i) inadequacy, (ii) glare. (*b*) Distribution: (i) too much in periphery of visual field, (ii) specular glare—reflected light near the object. (*c*) Contrast: great contrast in illumination between area viewed and neighbouring areas demands frequent rapid adaptation. (*d*) Type: flickering.

3. Nature of Object: (*a*) Minute details and the small visual angle they subtend. (*b*) Lack of contrast. (*c*) Lack of clear definition of object. (*d*) Contrast movement and fixation difficulties.

4. Ocular Factors: (*a*) Uncorrected ametropia. (*b*) Heterophoria. (*c*) Difficulties of accommodation. (*d*) Convergence difficulties.

5. Constitutional Factors: (*a*) Muscular fatigue of the eyes due to overwork, malnutrition, exhaustion, insufficient sleep. (*b*) Mental fatigue at the interpretation level, especially when interest and attention are called upon to interpret blurred and indistinct images.

When it is realized that all the above factors can produce eye strain and how many apply to the conditions under which television is watched, it is no wonder that television often causes eye strain. On the other hand, muscular adjustments occur which improve the ease with which the visual processes function and make it possible for the degree of eye strain experienced to diminish with practice, provided that the work demanded of the eyes is not beyond their capacities. Obviously an uncorrected myope will suffer from eye strain before a person with normal vision will under similar conditions. Repeated attempts at accommodation often end in ciliary muscle spasm which increases artificially the degree of myopia and accentuates any tendency towards myopia in those aged 8–13.

The symptoms of eye strain are well known. Ciliary muscle spasm, which is the result of muscle fatigue, produces periods of blurred vision. This is temporarily relieved by resting the eyes and by rubbing them. Children using grubby fingers often infect their eyes in this way, causing chronic blepharitis and conjunctivitis. Tired, uncomfortable, bleary, watery eyes and headaches are often the consequences of eye strain.

Discussion

This survey depends on indirect evidence in determining whether or not television viewing impairs children's eyesight. It assumes that those children who have television in their own homes, even if only recently acquired, have spent more time watching it than those who have no television. No special examinations were carried out for the assessment of visual defects among the children in the survey. All those who wore glasses or were known to have been prescribed glasses were counted in the defective-vision group. If any factor or factors other than television eye strain caused an increase in the incidence of glasses then the increase would apply to children of all age groups. The significant increase is, however, confined to children over the age of 10, and a simple explanation for this is that eye strain due to television viewing accentuates the normal tendency towards myopia in children aged 8–13 years. The effect of impairment of the eyesight of television viewers aged 8, 9, and 13 years is not shown in the figures obtained in this survey because children of these ages have not had vision tests during the last three years.

This survey does not prove that television viewing does affect children's vision, but the indirect evidence suggests this may be so. If we are to accept the findings at their

face value then the effect of television viewing on children's eyesight is a serious matter. The survey was carried out in Cardiff, no part of which is as much as 10 miles from the Wenvoe Television Transmitting Station, and where reception is therefore comparatively good.

Summary

19,280 junior and secondary modern school children were asked whether or not they had television sets in their own homes. According to the answers, they were divided into two groups, viewers and infrequent viewers. The number of children in each group wearing glasses or known to have been prescribed glasses was then determined.

It was found that the incidence of children wearing glasses was somewhat lower in the viewer group in children aged 7 to 9, but was significantly higher in children aged 11 to 14. It is suggested that the only explanation that will meet the facts collected during this investigation is that many of the older schoolchildren watch television so often, so long, and under such adverse conditions that it causes eye strain sufficient to impair the vision of some of them.

Recommendations.—(1) Parents should be warned against the possible dangers of allowing their children to watch television too often and too long. They should be informed of the optimum conditions for television viewing and the conditions which will cause eye strain. (2) Schoolchildren should have routine vision tests biennially at least. (3) Opticians and ophthalmologists should inquire more thoroughly into the environmental background of children when about to treat errors in their optical systems by optical corrections. (4) A more exacting investigation should be carried out to determine the effects of television viewing on children's eyesight.

I wish to record my thanks to Dr. W. Powell Phillips, Medical Officer of Health and Principal School Medical Officer, City of Cardiff, for permission to carry out this survey and for his active interest and encouragement. I am indebted to Dr. C. W. Anderson, his deputy, for advice and helpful criticism, and to the school nurses of the City of Cardiff for doing all the field work this survey entailed.

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Nova et Vetera

W. C. WELLS: A PRECURSOR OF DARWIN

1757–1817

The Anglo-American matrix of Western science has received more emphasis than ever before in the light of recent events, and the major figures in the hagiography have been duly exhumed and saluted as the appropriate occasions occur. Thus Count Rumford was the subject, four years ago, of a number of bicentenary tributes and at least one book. His fellow countryman, Dr. Wells, seems on the other hand to have eluded the commemorators in this the bicentenary of his birth.

William Charles Wells was born on May 24, 1757, the fourth child of an immigrant Scottish printer of Charlestown, South Carolina. As a young boy he was made to wear a tartan coat and blue bonnet that he might not be mistaken for an American. At 11 he was sent to school at Dumfries and at 13 entered the University at Edinburgh, where he stayed for a year. Then, at the age when other boys were continuing their education, he spent four years apprenticed to Dr. Alexander, of Charlestown, a distinguished botanical friend of Bartram and Peter Collinson and a thoroughgoing disciple of Linnaeus. The revolution drove him back to England, and he returned to the University at Edinburgh to spend three more years, following it up by work in London under William Hunter and at St. Bartholomew's Hospital. Like most of his contemporaries, he seized the opportunity to study at Leyden, though in his case he prefaced it by a short period of service as a military surgeon in Holland. Having obtained his M.D. at Edinburgh in 1780 he returned to America to look after his father's property. He was forced to abandon it when the insurgent forces occupied Charlestown. His precipitate departure did not prevent him from taking a printing press with him and establishing it in Florida. Afterwards he claimed that the first weekly paper in Florida was that produced on the press.

The end of the war found him back in England, where he had a difficult time making a living. This was in no way due to his lack of friends, but to his contempt for the apothecaries who might have brought him business. So it was not until he had established himself that his serious research could begin. He read many papers to the Society for the Promotion of Medical and Chirurgical Knowledge on various symptoms of diseases during the period 1790 to 1810, but his real scientific work was issued in the *Philosophical Transactions* of the Royal Society, to which he was elected in 1793.

Here his major contributions were "On the Influence which incites the muscles of animals to contract" (1795), "On the Colour of the Blood" (1797), and "On Vision" (1811). This latter paper substantiates his claim to be the first to experiment with the use of belladonna in the eyes. He also made the first exact explanation of the phenomenon of dew, which earned him the Rumford Medal of the Royal Society. But perhaps his greatest contribution to science was made in a paper read to the Royal Society in 1813: "An account of a female of the White Race . . . Part of whose skin resembles that of a Negro." In this he based his explanation on the assumption that there had been a biological evolution of the human species and accounted for the principle of natural selection by a struggle for existence and survival of the fittest.

Did Darwin know of this when he published the *Origin of Species* in 1859? We know he had read Malthus *On Population* in October, 1838, and that A. R. Wallace had come to the same conclusion whilst in the Moluccas. Apparently not, until it was pointed out to him by Charles L. Brace, the American philanthropist, with the result that in the fourth edition, published in 1866, of the *Origin of Species* Darwin acknowledged Wells as having "distinctly" recognized "the principle of natural selection." "This," he continued, "is the first recognition which has been indicated."

Darwin could have been forgiven for not knowing. The paper was republished posthumously, together with others, and in 1818 prefaced by an autobiography which Wells had dictated to his friend Samuel Patrick before his death in 1817 of heart trouble. He was unmarried and had no religious affiliations.

W. H. G. ARMYTAGE.

The Hydrogen Bomb, stated to be the first official booklet on the subject for the general public, is a 32-page pamphlet in non-technical language prepared by the Central Office of Information and issued last month by Her Majesty's Stationery Office (price 9d. net). After describing the explosion of a 10-megaton bomb, the booklet discusses the effects of blast, heat, and radioactive fall-out. It explains how best to save lives, minimize casualties and sickness, and maintain the necessary services for survival. It also discusses the roles of the Civil Defence services, and concludes that the survival of individuals and of groups would depend on sound planning beforehand.